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Device and method for extracting liquid samples

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Claims

1. Device for extracting liquid samples from containers and/or tubes (1) filled with a medium (2), in particular from fermenters, via a filter membrane (5) by means of a partial vacuum, characterised in that the filter membrane (5) arranged within a sample probe (3) comprises a material acting as a sterile boundary, whereby a supply line (6) which can be used to guide gas and a discharge line which can be used to guide the sample (7) are arranged on the sterile boundary side (5a) of the filter membrane (5).
2. Device according to claim 1, characterised in that the material acting as a sterile boundary is hydrophilic.
3. Device according to either claim 1 or 2, characterised in that the supply line (6) which can be used to guide gas contains a hydrophobic gas.
4. Device according to any one of the preceding claims, characterised in that the supply line (6) which can be used to guide gas and the discharge line (7) are designed to be suitable to supply and discharge gas with overpressure to and from the filter membrane (5).
5. Device according to any one of the preceding claims, characterised in that the supply line (6) which is able to guide gas is connected to a first gas-bearing connecting line to connect the supply line (6) to a gas supply connection (15).
6. Device according to claim 5, characterised in that a first and second valve (11,14) are arranged in the area of the first and second end of the connecting line.
7. Device according to either claim 5 or 6, characterised in that a pressure sensor (13) is arranged in the gas-bearing connecting line.

8. Device according to any one of claims 5-7, characterised in that a first sterile filter (12) is arranged in the gas-bearing connecting line.

5 9. Device according to any one of the preceding claims, characterised in that the supply and discharge lines (6,7) are designed to be suitable to supply and discharge rinsing liquids to and from the filter membrane (5).

10 10. Device according to claim 9, characterised in that the supply line (6) is connected to a second rinsing liquid-bearing connecting line (17).

11. Device according to claim 10, characterised in that the rinsing liquid-bearing connecting line (17) is connected to a container (18) containing a rinsing liquid (19).

15 12. Device according to any one of claims 9-11, characterised in that the container (18) is connected to a rinsing liquid supply connection (22) via a gas and rinsing liquid connecting line (20) with an another sterile filter (21) arranged therein.

20 13. Device according to any one of claims 9-12, characterised in that the container (18) is connected to another gas supply connection (23) via a gas and rinsing liquid connecting line (20) with another sterile filter (26) arranged therein.

25 14. Device according to any one of the preceding claims, characterised in that the discharge line (7) is connected to a device (8) acting as a valve.

30 15. Method for extracting liquid samples from containers (1) and/or tubes filled with a medium (2), in particular from fermenters, via a filter membrane (5) by means of a partial vacuum characterised by the following steps:  
- the supply of the gas to the filter membrane (5) arranged in the sample probe and comprising a material acting as a sterile boundary on the sterile boundary side of the filter membrane (5) by means of a supply line (6) which may be closed against other lines by at least one valve

- the discharge of the gas from the filter membrane (5) by means of the discharge line (7) and opening of a device (8) arranged in the discharge line functioning as a valve until the supply and discharge lines (6, 7) are sample-free
- the closure of at least one valve (11) to uncouple the supply line (6) from the gas supply connection (15)
- the extraction of the required volume of the sample from the medium (2) by means of the discharge line (7) and a partial vacuum present in the discharge line (7), and
- the transportation of the sample out of the discharge line (7) by means of new gas supplied by means of overpressure.

16. Method according to claim 15, characterised in that to avoid clogging and jamming within the discharge line (7) caused by the constituents of the sample, after the step in which the sample is transported out of the discharge line (7), a rinsing liquid (19) is supplied via the supply line (6) and discharged via the discharge line (7).

17. Method according to claim 16, characterised in that, after the step in which the rinsing liquid (19) is supplied and discharged, the steps in which the gas is supplied and discharged are repeated.

18. Method according to any one of claims 15-17, characterised in that an integrity test for checking/validating the sampling function comprises the following steps:

- the closure of the discharge line (7) by a device (8) acting as a valve
- the supply of gas to the supply and discharge lines (6,7) to generate a defined overpressure
- the closure of another valve (14) to uncouple the gas supply connection (15) from the supply line (6) with the involvement of a pressure sensor (13)
- the observation of any possible gas and/or liquids entering/or leaving the pipe system, and
- the observation of the pressure stability by means of the pressure sensor (13) as an indicator of the integrity of the filter membrane (5).